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Identification of Misconceptions in Jotform-Based Physics During The Covid-19 Pandemic

Dewi Dewantara ✉, Yulita Safitri, Eko Susilowati

Physics Education Department, Universitas Lambung Mangkurat
Jl. Brigjen Jalan Hasan Basri, Pangeran, Kota Banjarmasin, Kalimantan Selatan 70123, Indonesia
|dewantara_pfis@ulm.ac.id ✉ | DOI: https://doi.org/10.37729/radiasi.v15i1.1743|

Abstract

This research aims to explain the level of misconception experienced by students identified by the Four-Tier Diagnostic Test based on the JotForm for each subconcept of heat and heat transfer. The subject of this research were students of class XI MIPA 1 and MIPA 2 with a total of 78 students as respondents. The research method uses a qualitative descriptive research type. The research instrument is in the form Four-Tier Diagnostic Test questions using JotForm. Data collection techniques through shared links are then carried out by respondents with the help of Google Meet to monitor respondents and through interviews. The results of data acquisition are interpreted using an interpretation table and calculate the percentage of each category. Based on the results of the overall data acquisition, it shows that students in class one experience misconceptions in the moderate level category, while in the class other in the law level category. The highest percentage of misconceptions for each subconcept of heat and heat transfer experienced by students is in the concept of temperature. The data from this research can be used as a source of information regarding misconceptions that occur in heat material and heat transfer that need to be addressed in order to reduce the potential for misconceptions and efforts to overcome them.

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1. Introduction

The knowledge possessed by learners can be obtained from the educational process as well as their experiences in everyday life. In everyday life we often encounter the application of physics. Physics is a science built on facts. Various facts of phenomena contained in physics ranging from microscopic to macroscopic are formulated mathematically for mankind [1].

Physics learning at the high school level has several objectives, one of which is so that learners can have the ability to master the concepts and principles of physics, have the skills to develop knowledge and confidence as a provision to continue education at a higher level and develop science and technology. To gain an understanding of facts, concepts, principles, laws, and theories through the scientific process. The process of learning physics is not only presenting new ideas but changing old ideas owned by learners, because by the time learners enter a new learning stage, learners already have early knowledge of their daily experience and information obtained from the surrounding environment.

The initial knowledge that has been possessed by students can be referred to as initial concepts (preconceptions) [2]. Sometimes the initial knowledge possessed by learners is not in harmony with the scientific concepts that have been agreed upon by experts, this is referred to as misconceptions.

According to Alfiani in [3] misconceptions found in learners can inhibition the process of receiving new knowledge that is trying to be built through classroom learning. So that this misconception will affect the learning outcomes of learners. Several types of physics concepts that become the focus in discussing the misconceptions experienced by students, namely the concepts of temperature and heat, mechanics, and electricity [4]. The concept of heat physics is very closely related to life. Defining the concept of heat is very essential in order to be able to associate each phenomenon with the concept of heat.

The results of the initial study of research conducted by researchers with random sampling as many as 25 students. The results showed that as much as 53.85% understood the concept, not understand the concept as much as 26.92%, and experienced misconceptions as much as 19%. This indicates that there are misconceptions experienced by learners in heat matter and heat transfer, so there is a need to identify the overall misconceptions about misconceptions experienced by learners. Based on these indications, there needs to be an assessment that can collect information for teaching decision-making purposes, so that it is expected to hit the target. An assessment that can provide information about the difficulties, level of achievement, and basic abilities of learners is by using diagnostic tests. Diagnostic tests have functions that can be used for teachers as a step to update the learning process, while for learners can be used to improve the learning process [5].

Based on this function, the diagnostic test is expected to provide an accurate description of the misconceptions possessed by students provide answers to the question given. One form of development of diagnostic tests is the Four-Tier Diagnostic Test (FTDT). The development is contained in the added level of confidence of learners in choosing answers and reasons. The first level is a problem with four cheaters and one answer key that learners must choose. The second level is the level of confidence of learners in choosing answers. The third level is the reason learners answer questions, in the form of four reasons that have been provided and one open reason. Level four is the level of confidence of learners in choosing a reason [6].

The learning system in Indonesia is now turning into online learning using certain websites and media to support the learning process. Researchers who use the website to support the implementation of FTDT include research by Muhyi [7] using a four-level digital diagnostic test can identify learners' misconceptions more practically and effectively. Based on research by Hasanah [8] the result of the study indicate that the use of the website can be used as an evaluation tool for learning outcomes that is easy to use by educators and provides feedback to students quickly and objectively and obtains the percentage of students' misconceptions using FTDT based on Google Form.

The implementation of FTDT in addition to using Google Form, the use of JotForm is also effective and appropriate to collect data. Based on the above exposure, research was conducted to identify the misconceptions of learners in heat and heat transfer materials by utilizing JotForm on learning in the network of impact from the Covid-19 pandemic.

2. Method

This type of research is qualitative descriptive. The object of this study is the level of misconception of learners in certain parts of heat matter and heat transfer. The population in this study is all learners of the 2020/2021 school year. The Sampling using with random sampling technique by taking samples, namely students of class XI MIPA 1 and XI MIPA 2 which amounted to a total of 78 people consisting of 36 male students and 42 female students. Stages of research flow according to Miles and Huberman [9], shown at Table 1.

Table 1. Research Flow According Miles and Huberman

Stages	Information
Data Collection	*Collect data using FTDT, on heat material and heat transfer*
Data Reduction	*The process of data analysis by calculating the results of the data and analyzing is done to reduce and summarize the results of the study by focusing on the things that are considered important in the research.*
Display Data	*Presentation of data in the form of tables and diagrams to provide an overview of the percentage acquisition of misconceptions*
Conclusion	*Final stages in the research process to give meaning to data that has been reduced and analyzed*

The instruments used in this study utilize the JotForm website to collect data. The problem in this FTDT instrument is adopted from research by Sulistiawarni [6] valid and reliable. The reliability level of this instrument is very reliable at 0.985 and the validity rate of the medium category instrument is 82%. The data analysis technique used in this study is to interpret the data using an interpretation table that has been adopted from Fariyani, Rusilowati, & Sugianto [9] as in the following Table 2.

Table 2. Result Interpretation FTDT

Answer	Answer Confidence	Reason	Reason Confidence	Criteria
True	High	True	High	Understand
True	Low	True	Low	Misunderstand
True	High	True	Low	
True	Low	True	High	
True	Low	False	Low	
False	Low	True	Low	
False	Low	False	Low	
False	High	False	Low	
False	Low	True	High	
True	Low	False	High	Misconceptions
True	High	False	High	
False	High	True	Low	
False	High	True	High	
False	High	False	Low	
False	Low	False	High	
False	High	False	High	

The results of the data that have been obtained can be categorized based on the interpretation of the FTDT results into the criteria of understanding, not understand, and misconceptions according to table 2. The percentage of misconceptions can be calculated using:

$$P_n = \frac{s}{N} \times 100\%$$

P_N = percentage of misconceptions to-N, s = number of students who are categorised by misconceptions about to-n, N = number of students who are subjected to research

Categorize based on the percentage of students' misconceptions using a categorization of misconceptions Table 3.

Table 3. Category of Misconceptions

Persentage of Misconceptions (%)	Category
$0 < P_n \leq 30$	Low
$30 < P_n \leq 70$	Medium
$70 < P_n \leq 100$	High

3. Result and Discussion

The implementation of FTDT charging by utilizing the use of several applications, namely whatsApp, Google Meet and JotForm applications. WhatsApp application is used to facilitate the sharing of FTDT charging links. The Google Meet app is used to monitor learners when charging FTDT. The JotForm application is in the form of an online form to collect data derived from answers by learners. Jotform application provides 2 choices of form display to its users, namely in the form of classic form and card form. Classic form useful displays all questions in one full page while useful card form displays questions one by one, show at Figure 1.

Setting up forms in the JotForm application is essential, ensuring the data is verified and ensuring each data is unique. Jotform application has various supporting elements to facilitate users in the process of retrieving data by respondents. This makes it easier for users to apply FTDT to the JotForm application. For example, the choice of answers in the form of multiple choices, charging time settings, linear scales, etc. Users can add images to the issues that users create. Respondents can respond to the form of answers selected by learners by clicking on the web address or link that has been shared. Users can also set the time limit for workmanship to be visible to respondents, this maximizes response when working on FTDT. The results of the acquisition of values in JotForm can be directly arranged in data reporting, this is because users can set the value to be obtained based on the choice of data.

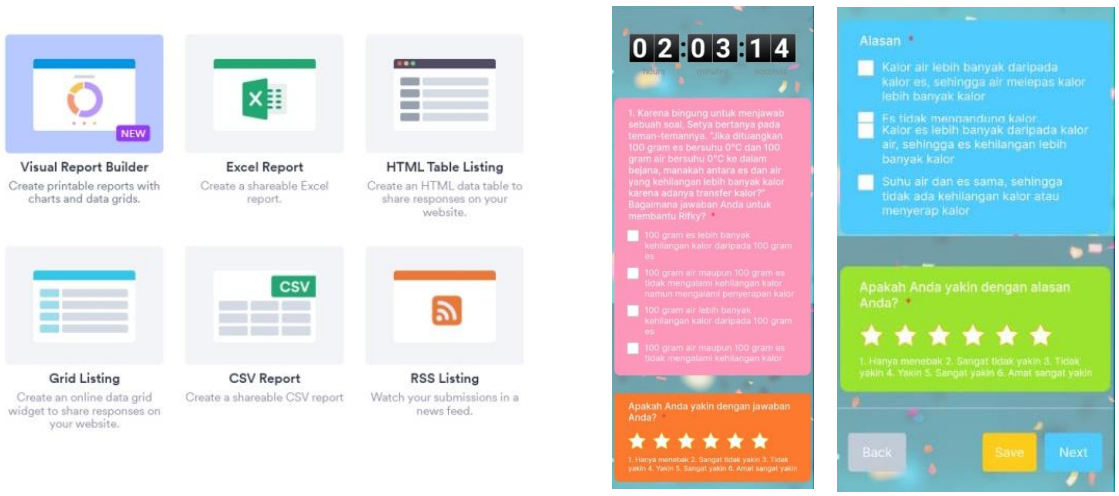

Figure 1. Report Form and Display of Questions FTDT on JotForm

The results of the data in this study are based on the answers of learners who are interpreted to find out the percentage of learners who experience misconceptions. Interpretation of misconception data is very important to find out the cause of misconceptions that occur in learners. Percentage Data of misconceptions of learners on sub-concepts of heat and heat transfer, shown by **Error! Reference source not found.**.

Table 4. Percentage Data of Misconceptions

Material	Sub-Concepts	Persentase	
		XI MIPA 1	XI MIPA 2
Heat and Heat Transfer	Heat	18,4%	29,5%
	Temperature	16,0%	16,0%
	Principle Black	17,6%	14,1%
	Heat and Temperature Change	15,8%	18,7%
	Heat and Change of state of Matter	15,3%	10,0%
	Heat Transfer	16,9%	11,6%

Based on Table 4, the highest percentage of misconceptions experienced by learners is in the heat sub-concept, in class XI MIPA as much as 18.4%, while in class XI MIPA 2 as much as 29.5%. The lowest percentage of misconceptions experienced by learners is in the sub-concept of heat and changes in the form of substances, in class XI MIPA 1 as much as 15.3% and XI MIPA 2 as much as 10.0%. Based on data, the group that experienced the most misconceptions in class XI MIPA 1 was categorized as low-level misconceptions by 90%, while in class XI MIPA 2 was categorized as a moderate-level misconception of 70%. The number of problem items used to identify misconceptions experienced by learners by using FTDT as many as 20 questions, being adopted from Sulistiawarni [6]. The percentage of various misconceptions value identified by FTDT, the following is a discussion based on students' answers to each sub-concept.

1. Sub-Concept of Heat

Indicator 1. Explaining the concept of heat (item number 1)

Learners in both classes identified misconceptions, they assume that the occurrence of heat release/ absorption can also occur when there is no difference in temperature. The proper concept is that heat can occur when a certain amount of energy moves from one object to another, then the temperature of a high objects will release heat while objects with lower temperatures will absorb heat [10]. The findings of this misconception are in line with research by Nursyamsi, Sujiono, & Yani [11] that temperature as a variable that depends on the mass of the material reviewed.

2. Sub-Concept of Temperature

Indicator 2. Affirming the concept of temperature (items of questions numbers 2, 3, and 4)

In question point number 2, learners in both classes identified misconceptions, they assume that the temperature is the same as the series of mathematical numbers. That is, if tonight is half the degree of last night's temperature, then tonight will feel 2 times colder and assume the temperature can be measured using human feelings. The findings of this misconception are in line with research by Sudewa, Suma, & Oktofa [12]. Learners who experience misconceptions assume that the skin can be used to measure cold temperatures and hot temperatures.

In question items numbers 3 and 4, learners in both classes identified misconceptions, they assume that the size of an object has an influence on the degree of heat or cold of an object. The findings of this misconception are in line with research by Fitriah [13]. Many students think that the size of an object affects the temperature. The proper concept is that the temperature of the object does not depend on the size of the object [13].

3. Sub-Concept of Black Principle

Indicator 3. Analyze thermal equilibrium events in the application of Black Principle (items of questions numbers 5, 6, & 7)

Based on the findings of misconceptions in both classes on question point number 5, learners in both classes assume that temperature depends on the constituent of the material. The findings of misconceptions in this point of question are in line with research by [14]. It states that it is the building material that determines the temperature of an object. The right concept is that if the two objects touch each other for a long period of time, then the temperature of an object will be the same, this happens because of the enactment of Black Principle in the event, where the wooden stick releases heat while the ice absorbs heat from the wooden stick ($Q_{out} = Q_{in}$) [15].

Finding misconceptions in both classes on question point number 6, learners assume that in the Equation of Black Principle, the final temperature is the sum of the temperature of both objects. These findings are in line with research by Etikamurni & Sutopo [16]. Learners are convinced by the answer, if there are two objects have different temperatures, then the final temperature of the mixture is to sum the temperature of the two objects.

Point number 7 is to connect the mass of the type and volume of objects that are inversely proportional to changes in the temperature of the object and proportional to the heat absorbed/ released by the object. In this case, learners in class XI MIPA 1 identified misconceptions, assume that the volume of objects is proportional to the difference in the temperature of objects, while in class XI MIPA 2, assumes that the mass of the type of object is proportional to the difference in the temperature of the object. These findings are in line with research by [3] that learners are unable to connect magnitudes in equations. In physical equations, density is proportional to mass and inversely proportional to volume, so the exact concept of volume is inversely proportional to temperature differences [17].

4. Sub-Concept of Heat and Temperature Change

Indicator 4. Describes the effect of heat on changes in the temperature of objects (item questions numbers 8 and 9)

Based on the findings of misconceptions in both classes, in the number 8 and 9 subject, learners assume that the temperature can flow from one object to another, and the temperature flows from a lower temperature object to a higher temperature object. Misconception findings in line with research [18], that students assume the temperature can move. The findings of misconceptions on this issue are also in line with the research by [11], that temperature is considered to move from a lower temperature

object to a higher temperature object. The right concept that can transfer a certain amount of energy is heat, and what can move is a certain amount of energy instead of the moving temperature [11].

Indicator 5. Determine the size of objects due to the effect of changes in the temperature of objects (items of questions numbers 10 and 11)

The numbers 10 and 11 are the coefficient of the length of the object proportional to the increase in the length of the object. In the point of question number 10, learners in both classes who experience misconceptions, assume that the coefficient value of the length of an object is inversely proportional to the square of the value of the increase in the length of an object. This shows that learners forget long-term equations. The findings of this misconception are in line with the research by Fitriah [13] that the ability of learners in low memory can cause learners to experience misconceptions. As for the point of question number 11, it is seen that learners in both classes can decipher the cause of heating is one way used to open jam bottles.

5. Sub-Concept Heat and Change of Shape

Indicator 6. Analyze the effect of heat on changes in the form of objects (items of questions numbers 12 and 13)

Point to question numbers 12 and 13, learners in both classes have understood that if there is an increase in the amount of heat received by an object, then the temperature of the object will increase to the boiling point of the object, then it will remain, accompanied by changes in the form of the object.

As for the findings of the misconception of learners in both classes on the number 12 and 13 question points, learners assume that if there is an increase in the amount of heat received by an object, then the temperature of the object will continue to increase, but the object will experience a decrease in temperature when it has reached the boiling point of the object. The findings of this misconception near similarities to the study by [3] that the temperature of the water will increase when experiencing a change in form. The right concept is at boiling point, the temperature returns still even though the heat continues to increase, until it becomes steam (gaseous form) [11].

6. Sub-Concept Heat Transfer

Indicator 7. Finding factors that can affect heat transfer (air pressure, heat capacity, and mass type heat) (item number 14)

Problem number 14 is to analyze the difference in boiling points of water in the highlands and in the lowlands. Finding misconceptions in this point, learners in class XI MIPA 1 assume that air pressure has no effect on temperature, although there is a difference in air pressure, the boiling point of water will remain at 100°C. While in class XI MIPA 2, learners assume that the air pressure at high altitudes is lower then the temperature will also be low which results in the water boiling process will last longer then the boiling point of water will be higher. The findings of this misconception are in line with the study by [15] the temperature of water heated over a longer period of time will continue to increase. The exact concept is that the boiling point in the plateau is lower than the boiling point in the lowlands, because the air pressure in the lowlands is higher then the boiling time will take place faster than the boiling time in the highlands [19].

Indicator 8. Applying the concept of heat transfer by conduction in everyday life (items of questions numbers 15 and 16)

The number 15 thing is that metal serves as a good conductor, which means it is easy to conduct heat from one object to another. Students in both classes have understood the conductivity of a material. Conductivity is the ability of an object to conduct heat [20]. As for the findings of misconceptions on

this subject, learners in both classes assume that the temperature can move. The proper concept is that heat is a number of energies that move from a high-temperature object to a low-temperature object [11].

Point number 16, most learners are right in choosing a reason, namely the amount of heat absorbed by an object will be directly proportional to the cross-sectional area of the wire and inversely proportional to the length of the wire in accordance with the equation of the rate of heat conduction [16]. But if based on the results of calculations, the results that can turn out to be wrong, it is seen that learners only remember the equations of the rate of heat conduction, but when learners put known physical quantities into the equation, the results are different from the right answers, this is due to learners who are less careful in the calculations or units used, to determine the magnitude of heat. The findings of misconceptions in this item are in line with the research by Zukhruf, Khaldun, & Ilyas [21] that learners are less careful in understanding the problem of physics.

Indicator 9. Applying the concept of convection heat transfer to daily life (items of questions numbers 17, 18, and 19)

Finding misconceptions in both classes on question point number 17, learners assume that air mixed with freon comes out of the refrigerator cabinet. Freon is the name of a chemical compound that was created for use as a working fluid in the refrigerator. Freon absorbs heat from ingredients stored in the refrigerator. The air coming out of the refrigerator has a cooler temperature than the temperature outside the refrigerator so that if the object has a lower temperature then the density of the type will be greater than the mass of the type of object that has a higher temperature, because the temperature is inversely proportional to the mass of the type, objects with a larger density will drop down, so that there is a convection current of air [22].

Some students in both classes in item number 18 have understood the example of the application of heat transfer by convection, namely heat transfer accompanied by a heat conducting substance. As for the findings of misconceptions in class XI MIPA 1, learners think the example is an example of the application of the concept of heat transfer by conduction, the proper concept of conduction is interpreted as the process of heat transfer without being accompanied by particle transfer but through an intermediate medium [11]. The findings of this misconceptions are in line with research by Nursyamsi, Sujiono, & Yani [11] that learners are accustomed to only memorizing concepts so that newly learned concepts are not able to be understood. While in class XI MIPA 2, students assume that the example is an example of the application of the concept of heat transfer naturally, whereas in the concept there are only three ways of heat transfer, namely conduction, convection, and radiation.

Finding misconceptions in both classes in question point number 19, learners in both classes are right in choosing a reason, namely the energy received by an object from the convection process, will be proportional to changes in the temperature and surface area of the object. However, if based on the answers of learners in both classes obtained a calculation of 150 Joules. The right answer is 150 calories. There is a difference between 150 calories and 150 Joules, seen in the question of the coefficient of air convection has units of kal/s.m^{2}° C. If using units of calories then the result obtained will be equal to 150 calories, but if using joule units then 150 calories should be converted to Joule units. The value of 1 Joule is equivalent to 0.24 calories, if changed using Joule units it will be obtained a large heat of 625 Joules, so it can be known that learners are less careful in reading the problem, especially in the units used. The findings of this misconceptions are in line with Zukhruf, Khaldun, & Ilyas [21] learners are less careful in understanding physical problems.

Indicator 10. Applying the concept of heat transfer by means of radiation to daily life (item number 20)

Findings of misconceptions in both classes on the point of question number 20, seen learners get radiation power values of 20×10^{1} σ J/s. In fact, large calculations of radiation power using the equation of radiation heat rate obtained by amount of 30×10^{8} σ J/s, however, students get results as large as 20×10^{1} σ J/s. This is because the learner first reduces the value of the two surface temperatures of the object then increases and multiplies by other known quantities in the problem it will be obtained by 20×10^{1} σ J/s. The right answer, namely by first categorizing each of the surface temperature values of the object, then reducing both surface temperatures of the object and multiplying by other known quantities in the problem will be obtained the value of radiation power as much as 30×10^{8} σ J/s. Identified learners were less careful in calculating the value of radiation power and some learners forgot the equation of radiation heat rate. The findings of this misconception are in line with the study by Zukhruf, Khaldun, & Ilyas [21] that learners are less careful in understanding the problem of physics.

Percentage of understanding of learners in class XI MIPA 1 on the concept of heat and heat transfer, identified with the number of questions as many as 20 points, the category of not understanding the concept occupies the highest position with a percentage of 51%, the percentage of misconceptions experienced by learners by 39%, and the percentage of learners who understand the concept by 10%. While in class XI MIPA 2, students who are categorized as not understanding the concept occupy the highest position with a percentage of 61%, a percentage of misconceptions of 29%, and a concept-savvy percentage of 10%.

The highest percentage of misconceptions experienced by learners in class XI MIPA 1 and XI MIPA 2 is in the heat subconception as much as 18.4%, while in class XI MIPA 2 as much as 29.5%. Based on the results of interviews with learners, information is obtained that learners use their own thinking and intuition to answer the question point. Misconceptions that occur in learners due to the construction of knowledge independently through interaction with the environment around them.

Factor that cause misconceptions experienced by students include the initial knowledge (preconceptions) possessed by the students themselves, the teacher or the learning carried out by the teacher [23]. Knowledge derived from teaching teachers cannot be transferred to learners. Learners are subjects who have the ability to actively seek, process, construct, and use knowledge [24]. Due to the development of knowledge independently by students which allows the occurrence of misconceptions of students.

4. Conclusion

Based on the results of this study it can be concluded that the percentage of misconceptions experienced by students of class XI MIPA 1 as a whole on the concept of heat and heat transfer is categorised moderately, which is 39%. Percentage of misconceptions experienced by learners in class XI MIPA 2 as a whole on the concept of heat and heat transfer is low categorized at 29%. As for the advice that can be given to teaching teachers to remediate misconceptions that occur in learners, namely: (1) using generative learning to adjust previous knowledge that has been possessed by learners with new knowledge that will be obtained through teaching and learning activities to understand a physical concept; (2) The use of blended learning models will encourage learners to be actively involved in learning, and (3) through demonstration of phET media is very useful to assist learners in understanding concepts factually.

References

[1] N. Zahra, Kamaluddin dan Muslimin, "Identifikasi Miskonsepsi Fisika pada Siswa SMAN di Kota Palu," *Jurnal Pendidikan Fisika Tadulako,* vol. III, no. 3, pp. 61-67, 2015.

[2] M. S. Zuhri dan B. Jatmiko, "Penerapan Model Pembelajaran Inkuiri (Inquiry Learning) Menggunakan PhET Simulation untuk Menurunkan Miskonsepsi Siswa Kelas XI pada Materi Fluida Statis di SMAN Kesamben Jombang," *Jurnal Inovasi Pendidikan Fisika,* vol. III, no. 3, pp. 103-107, 2014.

[3] S. N. W. Silung, S. Kusairi dan S. Zulaikah, "Diagnosis Miskonsepsi Siswa SMA di Kota Malang pada Konsep Suhu dan Kalor Menggunakan Three Tier Test," *Jurnal Pendidikan Fisika dan Teknologi,* vol. II, no. 3, pp. 95-105, 2016.

[4] P. I. Suwarna, "Analisis Miskonsepsi Siswa SMA Kelas X pada Mata Pelajaran Fisika Melalui CRI (Certainly of Response Index) Termodifikasii," *Jurnal Laporan Penelitian,* 2013.

[5] Zaleha, A. Samsudin dan M. G. Nugraha, "Pengembangan Instrumen Tes Diagnostik VCCI Bentuk Four-Tier Test," *Jurnal Pendidikan Fisika dan Keilmuan,* vol. III, no. 1, pp. 37-42, 2017.

[6] W. Sulistiawarni, "Identifikasi Miskonsepsi Menggunakan Four-Tier Diagnostic Test Materi Suhu dan Kalor Siswa SMA/MA," Universitas Islam Negeri Walisongo, Semarang, 2018.

[7] A. Muhyi, Pengembangan Tes Diagnostik Four-Tier Digital untuk Mengidentifikasi Miskonsepsi Siswa pada Konsep Gelombang Cahaya, Jakarta: Universitas Islam Negeri Syarif Hidayatullah, 2020.

[8] A. Hasanah, Pengembangan Instrumen Miskonsepsi Berbasis Google Form pada Materi Usaha dan Energi Menggunakan Four Tier Diagnostic Test, Lampung: Universitas Islam Negeri Raden Intan Lampung, 2020.

[9] Q. Fariyani, A. Rusilowati dan Sugianto, "Four-Tier Diagnostic Test to Identify Misconceptions in Geometrical Optics," *Unnes Science Education Journal,* pp. 1724-1729, 2017.

[10] D. C. Giancoli, Fisika Edisi Ketujuh, Jakarta: Erlangga, 2014.

[11] Nursyamsi, E. H. Sujiono dan A. Yani, "Identifikasi Miskonsepsi Materi Fisika Suhu dan Kalor Menggunakan CRI (Certainly of Response Index) pada Peserta Didik Kelas XI MIA SMA Negeri 8 Bulukumba Tahun Ajaran 2015/2016," *Jurnal Sains dan Pendidikan Fisika,* no. 2, pp. 44-54, 2018.

[12] P. H. Sudewa, K. Suma dan D. Oktofa, "Imlementasi Model Pembelajaran Perubahan Konsepstual untuk Meningkatkan Hasil Belajar Fisika Siswa SMKN 3," *Jurnal Wahana Matematika dan Sains,* vol. VIII, no. 1, pp. 61-76, 2014.

[13] L. Fitriah, "Diagnosis Miksonsepsi Siswa pada Materi Kalor dengan Menggunakan Three-Tier Essay dan Open-Ended Test Items," *Berkala Ilmiah Pendidikan Fisika,* vol. V, no. 2, pp. 168-181, 2017.

[14] F. N. Nabilah, J. Maknun, M. Muslim, A. Samsudin, L. Hasanah dan A. Suhandi, "Eleventh-Grade Student's Conception's About Temperature and Heat," dalam *MSCEIS 2018*, Bandung, 2019.

[15] G. C. Kesuma, R. Diani, N. Hasanah dan D. Fujiani, "Blended Learning Model : Can It Reduce Students Misconception In Physics?," dalam *Young Scholar Symposium on Science Education and Environment*, Lampung, 2020.

[16] D. P. Etikamurni dan Sutopo, "Peningkatan Penguasaan Konsep Siswa Kelas XI IPA pada Materi Suhu dan Kalor Melalui Modeling Intruction," *Jurnal Pendidikan : Teori, Penelitian, dan Pengembangan,* vol. IV, no. 2, pp. 172-177, 2019.

[17] H. D. Rahmayanti, S. Ardiani dan N. Akmalia, "Analysis of Paper Absorption From Dried Leaves As Potential of Future Organic Sanitary Pads," *Publipreneur Polimedia,* vol. VII, no. 1, pp. 19-23, 2019.

[18] T. A. Wulandari, T. Prihandono dan Maryani, "Analisis Miskonsepsi Siswa pada Materi Suhu dan Kalor di Kelas XI SMA Jember," dalam *Seminar Nasional Pendidikan Fisika 2018*, Jember, 2018.

[19] J. Firmansyah, "Eksplanasi Ilmiah Air Mendidih dalam Suhu Ruang," *Jurnal Filsafat Indonesia,* vol. I, no. 1, pp. 75-79, 2018.

[20] M. I. Alim, D. Mardiana, A. D. A dan D. Anggoro, "Uji Konduktivitas Termal Material Non Logam," ResearchGate, Surabaya, 2017.

[21] K. D. Zukhruf, I. Khaldun dan S. Ilyas, "Remediasi Miskonsepsi dengan Menggunakan Media Pembelajaran Interaktif pada Materi Fluida Statis," *Jurnal Pendidikan Sains Indonesia,* vol. IV, no. 1, pp. 64-78, 2016.

[22] M. Kanginan, Fisika Untuk SMA/MA Kelas XI, Jakarta: Erlangga, 2016.

[23] Y. Yuliati, "Miskonsepsi Siswa pada Pembelajaran IPA serta Remdiasinya," *Jurnal Bio Education,* vol. II, no. 2, pp. 50-58, 2017.

[24] A. Hidayat, Zainuddin dan Misbah, "Pengembangan Bahan Ajar Suhu dan Kalor Menggunakan Pembelajaran Generatif," *Jurnal Ilmiah Pendidikan Fisika,* vol. IV, no. 3, pp. 151-160, 2020.